TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

COST-EFFECTIVE, IN SITU REMEDIATION OF STRONTIUM-90 IN GROUNDWATER

Identification No.: RL-SS07
Date: September 2001

Program: Environmental Restoration
OPS Office/Site: Richland Operations Office/Hanford Site
Operable Unit(s): 100-NR-2
PBS No.: RL-RC01 (RL-ER08)
Waste Stream: Groundwater (Disposition Map Designation: ER-10 [technical risk score 5] and ER-18 [technical risk score 5])
TSD Title: N/A
Waste Management Unit (if applicable): N/A
Facility: N/A

***Priority Rating*:**

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:

_X_ 1. Critical to the success of the ACPC
____ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

***Need Title*:** Cost Effective, In Situ Remediation of Strontium-90 in Groundwater

Need/Opportunity Category: Technology Need

***Need Description*:** Remediation of soluble strontium-90 in the groundwater is needed to reduce risk to human health and the environment. Monitored Natural Attenuation (MNA) is considered as potential remedial measure that may address some portion of the contamination. An improved technical basis for quantifying natural attenuation processes of stontium-90 in the Hanford subsurface is needed to support evaluation of MNA. (Also see Science needs RL-SS33-S, RL-SS34-S, and RL-SS36-S)

Schedule Requirements:

Earliest Date Required: 9/30/00

Latest Date Required: 9/30/09

Pump and treat operations are ongoing as an expedited action. An interim record of decision (ROD) was issued in 1999 selecting an interim remedy of pump and treat. The interim ROD includes a requirement to evaluate of other technologies by FY04.

***Problem Description*:** The 100-N Area is located near the Columbia River and includes one nuclear reactor previously used for plutonium production. In the 100-NR-2 operable unit, the primary sources of contamination are ditches and cribs. Groundwater in the 100 Area ultimately discharges to the Columbia River. The principal contaminant, strontium-90 (half-life 29.3 years), is present in groundwater at activities up to 6000 pCi/L. Maximum concentrations of the plume range from 4,000-6,000 pCi per liter with depth to the water table of 70-80 feet at the source. Plume thickness ranges from 13 to 40 feet. The estimated total inventory of contaminant in both the groundwater and soils ranges from 75 to 89 curies.

The immediate objective is to prevent further migration of Sr-90 into the Columbia River. The long-term objective is to reduce Sr-90 levels to below drinking water standards. An existing pump & treat expedited response action (ERA) has been implemented to help reduce the flux of Sr-90 to the river. The low mobility of the strontium-90 reduces the removal effectiveness to the point that natural radioactive decay removes the contamination almost as fast as the pump and treat operation combined with radioactive decay. Thus, the main purpose of the pump and treat system is for containment while natural decay reduces the source. If containment must be maintained until the highest concentrations in the plume (6,000 pCi/liter) decay to the Safe Drinking Water Act Standard of 8 pCi/liter, the aquifer will need to be contained for 280 years.

A stated desire of the Hanford Advisory Board is to develop technologies to remove strontium-90 in the groundwater near the river with an in situ process like soil flushing. There is a strong preference towards contaminant removal. An important consideration with any contaminant removal process is to assure complete capture of any mobilized contaminant. Although this is a stated desire, other containment and immobilization strategies are still being considered if removal proves to be impractical.

This problem is currently being assessed using the Innovative Treatment Remediation Demonstration (ITRD) process. As part of the ITRD project, the migration of the Sr-90 plume was modeled to assess the potential for movement of Sr-90 into the river. Additionally, a screening-level assessment of applying Monitored Natural Attenuation for the plume was prepared. A final ITRD project report describing assessment activities, the remediation and characterization technologies reviewed by the ITRD, and recommendations from the project will be completed by December 2001.

Benefit to the Project Baseline of Filling Need: Using the baseline pump-and-treat technology for the plume is projected to require long remediation times with high operational costs. Currently, there is no technology identified that appears to be cost effective in treating the plume. Thus, identifying and implementing a cost effective in situ treatment technology should improve the cost and schedule baseline for the project.

***Functional Performance Requirements*:** Reduce strontium-90 activity to the Safe Drinking Water Act criteria of 8 pCi/L for any water entering the Columbia River.

Work Breakdown Structure (WBS) No.*:** 1.4.03.1.1.07.08.09.02 ***TIP No.: TIP 0004

Relevant PBS Milestone: PBS-MC-029

***Justification For Need*:**

Technical: Remediation of strontium-90 in the groundwater is presently in progress at 100-N Area via pump and treat. Pump and treat has been ineffective due to difficulty in extracting Sr-90 from the aquifer. An in situ remediation process will negate the need for extraction and ex situ treatment.

Regulatory: Strontium-90 in groundwater exceeds the Safe Drinking Water Act standard of 8 pCi/L.

Environmental Safety & Health: Possible exposure to strontium-90

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: The estimated life-cycle cost savings associated with filling this need is $50M. This estimate is based on an assumed savings of 5% of the total Hanford groundwater management life-cycle cost of $1.2B.

Cultural/Stakeholder Concerns: Stakeholders may not accept immobilization or precipitation methods that do not actually remove strontium-90 from the aquifer.

Other: None.

Current Baseline Technology: Extraction of groundwater and ex situ treatment with zeolite. Clean process water is reinjected into the aquifer.

Cost: Budget for pump and treat at 100-NR-2 is about $0.6M in FY01. Cost estimates for out years have not been completed.

Waste: Spent zeolite disposed on site.

How Long It Will Take: Interim remediation measures have commenced and will continue for several years or until alternate treatment strategies/technologies are approved.

End-User: Richland Environmental Restoration Project

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